Name _____ Period _____ Date _____

ACCURACY AND PRECISION

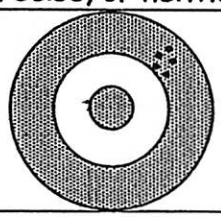
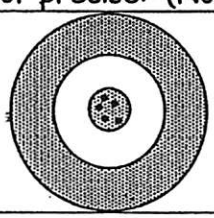
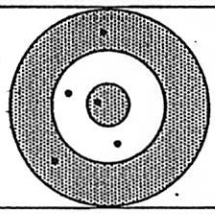
Definitions:

Accuracy – how close a measurement is to _____

Precision – how close a measurement is to _____

Precision versus Accuracy:

Look at each target and decide whether the "hits" are accurate, precise, both accurate and precise, or neither accurate nor precise: (Note: An accurate "hit" is a bulls eye!)

		
Accurate?: Yes / No Precise?: Yes / No	Accurate?: Yes / No Precise?: Yes / No	Accurate?: Yes / No Precise?: Yes / No

Precision Problems:

A group of students worked in separate teams to measure the length of an object. Here are their data:

Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7
2.65 cm	2.75 cm	2.80 cm	2.77 cm	2.60 cm	2.65 cm	2.68 cm

- The average length is _____ cm.
  This is the mean or average.

- Subtract the highest value from the lowest value: _____ cm.
  This is the range or spread.

- Divide this number by 2: _____ cm.
  This is the approximate ± range from the average.

- The precision of the measurement can be shown as average ± range.
  The precision of the measurement was _____±_____ cm.

A second group of students obtained the following data:

Team 8	Team 9	Team 10	Team 11	Team 12	Team 13	Team 14
2.60 cm	2.70 cm	2.80 cm	2.75 cm	2.65 cm	2.62 cm	2.78 cm

- The average length is _____ cm.
- The precision of the measurement was _____ ± _____ cm.

In comparing groups, the first or the second, which group was more precise or was the precision the same? **Justify your answer.**

Expressing Errors in Measurement:

Scientists often express their uncertainty and error in measurement by giving a percent error. The percent error is defined as:

$$\%\ \text{error} = \frac{\text{actual value} - \text{measured value}}{\text{actual value}} \times 100$$

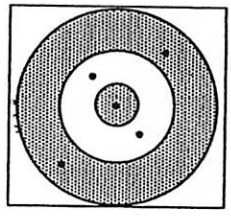
Answer the following four questions. Pay attention to significant figures, and show your work!

1. While doing a lab, a student found the density of a piece of pure aluminum to be 2.85 g/cm^3. The accepted value for the density of aluminum is 2.70 g/cm^3. What was the student's percent error?

2. A student measured the specific heat of water to be 4.29 J/g · C°. The literature value of the specific heat of water is 4.18 J/g · C°. What was the student's percent error?

3. A student took a calibrated 200.0 gram mass, weighed it on a laboratory balance, and found it read 196.5 g. What was the student's percent error?

4. Accuracy is often expressed as an average of several measurements. Look at the target to the right. In your opinion, how well do the measurements on the target represent: **(Justify your opinion.)**



a. Accuracy?

b. Precision?